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(COMMONLY CALLED NEAR-SIGHTEDNESS.)

IN ITS VARIOUS PHASES.

BY

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Professor of Eye and Ear Diseases in the University of Maryland, Surgeon in Charge of the Presbyterian Eye and Ear Charity Hospital. etc., etc., etc.

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[*Revised from September No., 1880, Virginia Medical Monthly.*]

Near-sightedness, or, as it is scientifically called, *myopia*, is well understood by those who have made the diseases of the eye a special study, but to the greater number of medical men this common disease is enveloped in a vaguely defined and misty pathology. Most physicians are aware that in myopia there is some defect of the focusing of the eye as an optical apparatus, but why the machinery of the visual organ does not work as it ought to do is not so clearly appreciated. Some have a settled impression that the eye-ball is elongated, and hence a disturbance of those nice relations which the varied contents of the eye should have with each other. They speak of the eye as a long eye, with alteration in shape from the typical eye, which should be nearly as round as a ball.

The world has assumed that in all near-sighted persons it is the front of the eye, which has become more convex. Many physicians hold to this erroneous opinion which they had imbibed before they had entered the medical ranks, and which

error has never been corrected. The junior members of the profession who have recently pursued their medical studies in the large cities, have had better advantages for obtaining an insight into the specialties in medicine. They have been taught that in most near-sighted eyes there is an elongation in the long diameter of the eye from the pupil backwards, and not in the increased convexity of the cornea. There is to be sure a rare form of near-sightedness in which the elongation of the eye is due exclusively to the protrusion forwards of the cornea, the centre of which projects outwards as a cone—a disease called *conical cornea*. This pathological condition is, however, so very rare that it would not explain one case of near-sightedness out of one thousand. Where a perfect eye has become myopic, the elongation of the eye-ball is usually found in the bulging of the back wall or sclerotic coat near the entrance of the optic nerve, and to which the most elaborated portions of the retina, with choroidal backing, is attached.

This explanation, viz: the pushing out of the back wall of the eye-ball, which is applicable to the majority of adult near-sighted persons, does not, however, cover the entire field of myopia. Some old persons, markedly near sighted, whose sharp vision extends to a very few feet, have experienced no change whatever in the length of this ocular diameter. In this small class of myopes an explanation of the optical defect is found in the change of shape in the lens alone. Again, in a very large number of young persons who have restricted distant vision, near-sightedness is found associated with an eye that is actually shorter in this antero-posterior diameter than a good eye should be. It is in the act of habitually straining such a flat eye to make it see sharply small, near objects, that the ciliary or accommodating muscles within the eye-ball become irritable, and finally are thrown into a spasmodic contraction, with inability to resume voluntarily a passive or relaxed state. It is this excessive muscular contraction, continuously kept up, which makes the lens too convex, shortens its focus, and puts an end to distant vision, by blurring the definition of objects across the street, and induces near sightedness.

All of these varied conditions cause myopia. They represent functional as well as organic changes, and are found at various stages of life. Some of them only show themselves in persons well advanced towards extreme old age, while others are restricted to childhood or school days. We must now add to this list of acquired near-sightedness a number of eyes, congenitally defective in shape, which, in intra-uterine development, had become longer than a typically good eye should be. Such transmitted peculiarities of an elongated eye-ball form, however, the exception in the great list of myopes, as comparatively few of the great number of near-sighted persons are as yet indebted to their parents for this peculiarity.

Near-sightedness is capable of easy recognition in its various forms—sharp near sight with foggy distant vision establishing the diagnosis. The first natural division among the myopics would be into those who are born with long, misshaped eyes (congenital myopia), and those who acquire near-sightedness, whether from changes occurring in the shape of the eye or from variations in form of the crystalline lens. Some of these conditions are permanent, while others may be very transient.

Observation teaches us that myopia runs in families, and that some children are near-sighted because their parents were so before them. Peculiarity of features are clearly inheritances, and a long eye is a well-defined individual peculiarity, which places itself in the hereditary list for transmission. Every child born of near-sighted parents is, however, not of necessity near-sighted, and fortunately myopic parents are not yet so very numerous as to establish a heavy percentage of congenital cases. In this respect, however, nations differ. In some parts of Continental Europe, we find a larger percentage of myopes among the adult population than in other countries. This is especially the case when we contrast the population of the largest and oldest cities with the agricultural classes. We find correspondingly in such cities a larger number of children who commence life with near-sighted eyes.

The defective eye-sight of the human race has been carefully investigated in most of the civilized countries, and with this well-

established result, viz: that myopia is not often met with among the peasantry of any country. It is found most commonly in the large cities, in which is felt the necessity for more mental exertion among young persons, in preparation for securing a more comfortable living in the future. This exertion is expressed by the closer and longer continued daily application of eye-sight in study.

The collecting of children in the public schools, offers great facilities for the study of eye defects, and the relative frequency of such eye diseases in the cities and in the country. From Germany, Russia, Austria, Switzerland, France, England and America we are now in possession of such accurate data; and all of these investigations, made by the scientific specialists of these respective countries, singularly confirm the above statement.

With reference to near-sightedness, a striking difference is found between the smaller children entering the schools and the graduating classes in the same schools; and a similar proportion is sustained if the same children are followed up in the successive classes from their admission to their graduation. In country schools, the number of near-sighted children in the lowest classes may not reach 2 per cent. of the pupils. As this very small per centage of little people came with near-sighted eyes into the school, and have not yet advanced beyond their alphabet in education, they clearly should be classified with cases of inherited myopia, the offspring of myopic parents. This percentage of inherited near-sightedness is much increased in the infantile classes of city schools until as much as 13 per cent. is reached in the largest and oldest cities of Germany, making this large number their starting point for eye defects in school life.

Every year of study adds to the percentage of myopic children. This near-sighted condition of the eyes shows a steady increase in all literary institutions, growing *pari passu* with the amount of application and intellectual development of the young persons, until it attains its highest degree in applicants for collegiate honors. Some of the graduating classes in the highest schools of the Continent of Europe exhibit the frightful amount of 70 per cent. of near-sighted students. If we take 5 per cent. as an

average of city and country schools among the pupils six years of age, meaning those in the primary classes, as marking the near-sighted children by inheritance, and 50 per cent. as the average of the graduating classes in the highest schools, we have 45 per cent. as indicating the acquired cases of near-sightedness. This number of near-sighted or weak-eyed persons is being continually added to the intellectual and learned population of the civilized globe.

From these figures it would really appear as if our higher education was threatening the ruin of the eye-sight of our race. The observant citizen sees many more young persons using spectacles now than formerly, and hears constant complaints of defective eyes among his young friends, apparently out of all proportion to his former experience. That eye diseases are on the increase there can be no question, and our school system has been justly charged with the growing trouble.

The eye, like any other very delicate instrument, is capable of abuse, particularly during its growing period. Although it may attain its full size at 12 or 14 years of age, its protecting walls do not secure firmness and the full powers of resistance until the maturity of the rest of the body. Up to twenty years of age, the eye is liable to injury from over-work, and this is more especially the case between the school years of 6 and 16.

In studying the anatomy and physiology of the eye, we find a ready explanation for those organic changes which are brought about in myopia. At the commencement of school life—say from 6 to 8 years—we find the eye-ball a hollow organ, filled with fluid, with comparatively thin, soft walls, and very richly supplied with blood-vessels. It has already nearly attained its full growth as to size and the development of its intricate contents ; but its outer sclerotic wall, which is to fix the shape of the organ, is not as thick, dense, tough and resisting as it will be when the body attains maturity. At this stage of bodily development the lens within the eye of the child is well formed, and is of so elastic a nature, from the juiciness of its fibres, that it can readily change its shape and approach the globular form when strongly acted upon by the accommodating muscle. This in-

creased convexity of the lens prepares it for condensing light upon the retina for near and small objects.

It must be remembered that the eye is like a microscope, with lens adjusted by nature to focus light upon the retinal surface, the distance from the inner face of the lens to the rod and cone layer of the retina being fixed. Any change in these relations must seriously affect the eye when adjusted for near or distant vision. When the retina is removed from the fresh eye, it is recognized as the thinnest of membranes ; *yet it is only the outer surface of the membrane that is called the percipient layer.* It alone can receive the image of objects looked at. Any other part of the many layers of varied structure which enter into the thickness of the retina, will not answer this purpose of vision. In this respect the retina resembles the prepared glass upon which the photographer makes sun pictures. Light must be focused upon the specially prepared surface of the plate, regardless of the thickness of the glass. When a transverse section of this thin film of tissue of retina is put under the microscope, it exhibits a heterogeneous structure of seven or eight transparent layers. It is only the outer one, representing about one-fourth the thickness of the entire membrane, which is subservient to the reception of an image, viz.: the rod and cone layer. Should the lens focus on any other part of the retinal thickness, no clear sight would result, as no other part of the retina but that outer surface, backing upon the pigmented choroid coat, is designed for the reception of visual impressions. In a normal eye of proper dimensions, with the full powers of accommodation for distant and near objects, the relation of lens to this percipient layer of the retina must not only be of a certain determined character, but they must also be immovably fixed in this relation. The outside, thick, tough, resisting, inelastic, sclerotic envelope of the eye-ball is the brace which must keep up these accurate relations by preventing the eye from changing in anywise its natural shape.

We have referred to the eye-ball as a hollow organ nearly an inch through in its various dimensions, a shade deeper in its antero-posterior diameter than in its horizontal or vertical diameter. Its outer shell of clear cornea in front, and the opaque sclerotic

coat for five-sixth of its back surface, gives it shape. This is lined within by the extremely vascular and pigmented layer called the choroid, with the colored muscular septum of iris attached to its anterior border. The retina, as the especial organ for perception, lines this choroid on its inner side. These three layers of sclerotic, choroid and retina, bear the respective relation of brick wall, plaster coat and papering of an ordinary room, and in about the same relative proportionate thickness. The entire cavity of the eye-ball is filled with a transparent liquid between lens and cornea, and a more consistent, clear fluid, the vitreous mass, filling up the bulk of the cavity. The crystalline lens of a denser, transparent substance is placed directly behind the pupil, and is fixed in this intermediate place by the suspensory ligament This lens is made up of hundreds of layers of elastic, transparent fibres, giving the whole mass the shape of a bi convex lens of about 5/8 of an inch focal power, which corresponds to an exceedingly strong magnifying glass. The ciliary bodies which change the shape of the lens, and surrounds its outer margin as a kind of fluted collar, are well secured to the inner face of the eye-shell at the junction of the iris and the choroidal linings. Through their agency, they being muscular and possessing the power of contracting, the surfaces of the crystalline lens become more convex as near objects are viewed, and this physical change, which increases the strength of the lens, is recognized as the accommodation of the eye. The cornea, lens, and fluid contents of the eye, all act as condensing media, and all, therefore, possess magnifying properties. They are classified together as the dioptric media, or the light-condensing apparatus.

Although the retina or sensitive nerve layer lines the entire back chamber of the eye-ball and covers nearly a square inch of surface, very little of it is used for our best vision. All the light which passes into the eye is condensed by the lens upon a point not larger than a small pin head, and as we face everything that we desire to see well, this small area of the retina is placed in a straight line directly behind the pupil. This little section of the retina, not more than a half line square, is worth all of the rest of the retina put together. It is the most elaborately developed

part of the sensitive nerve layer, and is known as the fovea centralis or the yellow spot of Soemmering. It is on this little spot that all perfect microscopic pictures of whatever we look at are condensed by the focusing lens. This yellow spot in a good eye, capable of any kind of work, near or far must be fixed at a determined distance from the back of the lens so as to catch the concentrated light. It must undergo no change of place whatever, and hence it is supported by a very heavy backing of the thickest part of the eye-walls. The entrance of the optic nerve into the eye-ball is within two lines of the yellow spot. During the accommodation of the eye for near objects and while the changes in the shape of the lens, needful for this act, are being produced through the contraction of the ciliary muscles the posterior pole of the lens never moves from its fixed position, however much the curved sides of the marginal edges of the lens may vary in place.

In the working of the eye as an optical apparatus, the adjusting of the lens to focus light at varied distances is the especial action of the muscular elements of the ciliary bodies. When an eye-ball has been cut in half midway between the cornea and the optic nerve entrance, the curious collarett which is seen approaching the circular edge of the lens, is the accommodating apparatus for changing the focal power of the lens. These radiating bodies of prismatic shape, and about sixty in number, which form this deeply pigmented circular layer, are made up chiefly of blood vessels and muscular fibres hid away under and between masses of pigment cells. It is the muscular element of these ciliary bodies which, in the living eye, plays the part of the adjusting screw of the opera glass. By the varied muscular contractions of these bodies, acting upon the lens, during our waking hours, all light passing through the pupil is at once concentrated upon the yellow spot to form a perfect diminutive picture of whatever is placed before us, regardless of the various distances from which the light comes, or the object upon which the normal eye may be directed.

The working of the eye is a muscular act. Muscles, when overworked, will exhibit fatigue, which is often expressed by painful sensations. They can also become irritable when over-used, and

then will work irregularly, sometimes even spasmodically. Such irritable contractions may become more or less permanent, and keep the lens in an unrelaxed condition of greater convexity.

All organs, when in use, need an over blood supply. Immediately after taking a hearty meal, the stomach requires so much blood from the rest of the body to carry on digestion that, with many persons, a sensation of chilliness of the skin is occasioned. After much walking, our legs swell, as evidenced by our boot tops tightening around our engorged calves. After much mental work, the head feels full, and the brain, if visible, would appear reddened from an increased circulation. So it is with the eye. Eye-work is inseparably connected with the ordinary wear and tear of the organ in use, which calls for an additional amount of the nutrient fluids of the body to repair the loss.

The intensity of eye work is measured not only by the length of time that the eye is being used, but also by the degree of contraction of the ciliary muscle; and both conditions are inseparably connected with local congestion. When the intra-ocular muscles are thrown into spasmodic action; they induce and ensure a temporary hyperæmia of the interior of the eye ball; and, necessarily, an increase in the contents of this hollow organ. Should this condition of muscular activity be frequently excited, and for a long time kept up in an eye not yet hardened by the complete development and maturition of its protecting layers; the comparatively soft eye shell, as found in the child, shows a disposition to yield at its weakest point where the optic nerve fibres enter the sclerotic coat, and the foundation for a posterior staphyloma is laid. *Staphyloma* is the term given to the bulging of the walls at the back of the eye, which, by elongating the antero-posterior diameter of the eye ball, makes the organ permanently near-sighted. When once the beautiful symmetry of the ocular walls is disturbed by this bulging, the eye never can regain its normal shape. It is ever afterwards liable to become further distorted, until it is seriously disturbed in its working capacity, and *becomes a very near-sighted eye, which is always a seriously diseased one.*

The working of the ciliary or accommodating muscles within the eye-ball is always associated with the action of the outside recti-muscles. When the four recti muscles clasp the outside of the eye-ball. they strengthen the sides of the organ, but concentrate the strain on the back at the weak optic nerve entrance. Unfortunately, there is no great distance between the optic nerve entrance and the yellow spot of Soemmering—that elaborated portion of the retina which is designed for the reception of the condensed picture in all sharp vision. Very little over a line in measurement marks the distance of this all-important portion of the sensitive layer from the point where the eye is giving way. In the bulging, especially if excessive, this yellow spot must be displaced backwards.

In using a powerful microscope, a very slight motion imparted to the cylinder by a turn of the adjusting screw, although it causes no visible movement in the body of the instrument, materially affects the focus of the lenses, and blurs the object which before was so sharply defined in the microscopic field. So it is with the eye. We have already said that to see distinctly, light must be sharply concentrated by the crystalline lens, on the back layer of the thin film of tissue called the retina or sensitive nerve layer of the eye. Should this accurate focusing of light fall on the middle or the inner surface of this delicate membrane, it would produce a blurring of the image, such as is seen by near-sighted persons when they look at distant objects. It does not, therefore, require much drawing back of this membrane to cause a positive impairment of vision. A fraction of a line will produce decided disturbances in the condensation of light coming from a distance, and produce a very foggy horizon. Should this retinal membrane recede for the space of a line, which is comparatively a very little distance, it would make the eye so very near-sighted that one could hardly see beyond his nose.

This tendency to yielding of the human eye from study is peculiar to its growing state. When the eye is well hardened by full growth. as it is at maturity, a much greater amount of eye application can be borne continuously without fear of bulging the eye shell and injuriously changing the shape of the organ. At

the age of 20, a good eye can be abused by over-work in many ways, but without producing myopia. One-fourth of the same application at the age of 10, with an eye yet soft in the structure of its sustaining envelopes, would cause the eye to give way in its back wall, and bring about the disease of near-sightedness.

Myopia is most frequently an acquired condition, dependent upon the over-use of the eyes at an early age, and especially during school life. This condition, although excited immediately by the over-work of the organ, can be hastened and augmented by the physical condition of the scholar and his surroundings. Nothing is so conducive to defective health of the growing body, the eye included; as the crowding of many children in badly ventilated and defectively lighted school rooms, in which they are made to sit day after day, and for many consecutive hours. This confined atmosphere is tainted with the exhalations from their own bodies, and in winter often with the noxious gases of defective stoves. Into these school rooms, during the many long winter months. fresh wholesome air is admitted only through the accidental opening of a door to give entrance or exit to some of the numerous inmates. Living for so many hours a day in this impure air of the school room, the body becomes slowly enfeebled, and the tissues lose their power of resistance. They become flabby and soft, and when pressure is made upon them from over-exertion, they give way.

In most of our schools, there seems to be one paramount object before the minds of the teachers, and it absorbs every other consideration. Children are sent to them to have their brains developed, and the rest of their bodies seems to be of very secondary consideration to the teacher. School books are, therefore multiplied *ad nauseam*, and lessons lengthened without mercy, necessitating additional hours of prolonged study out of school, which can be so much more profitably spent in bodily exercise. Teachers will not be sufficiently impressed with the important fact that the eye, especially in its growing state, is capable of abuse; and that while excessive use tends to increase the fluid contents of the visual organ, it requires a matured eye-

ball to resist the injurious distension to which the growing eye of a child when exposed so readily yields.

When the walls of a house bow out from the perpendicular, the strength of the structure is seriously impaired, and so is it with the human eye. As an additional weight causes the wall of the building to yield the more—even to the final destruction of the edifice—so does increased study during school life, with a yielding wall of an eye, cause an increase in the bulging, and a serious disturbance in the organic structure, as well as in the functions of the organ. *As no one expects the bowed wall of a house to right itself, so the bulging near-sighted eye has no chance of ever shrinking back to its normal dimensions, the popular opinion to the contrary notwithstanding.* A stretched membrane, that cannot regain its normal position, becomes necessarily a weak one, and acquired near-sightedness by weakening the structural envelopes of the eye, lays the foundation for many serious organic diseases.

Nature, as a rule, makes the eye right, but over-exertion of it at too early an age brings on disease. We have already stated that the examination of the students in the public schools in country and city conclusively proves this. It has also been shown that near-sightedness is greatest among the most studious, so that the number of persons wearing glasses can be, in a measure, taken for the intellectual standard of a community, and it also exhibits the forced education of childhood. Near-sightedness may be considered one of the signs of mental culture in reference to small as well as large communities. I do not mean by this that only the weak-eyed of a town are the book-worms, for all eyes do not, fortunately, give way under abusive work.

Some of the school statistics give curious data in support of the established fact that a higher education threatens serious injury to the eye sight of our race, both through acquired and afterwards transmitted near-sightedness. Starting with normal eyes so constantly found among all primitive people, and with the properly shaped eyes of the inhabitants of rural districts, who, with limited education, devote their lives to tilling the soil, we find an increase in the number of misshaped eyes among the children of the in-

habitants of the older cities, and especially in certain countries, as a starting point for the great increase in acquired near-sightedness as found in the advancing classes of the public schools. Germany heads the list in the greatest number of myopic children. As an evidence of the transmitting of these defects to offspring, we can readily trace in our largest American cosmopolitan cities the influences of a foreign population in disseminating these eye defects. The largest number of near-sighted children in the primary classes of our public schools are of German parentage.

Dr. Macnamara's experience in India as regards the absence of myopia among the uneducated classes of that country, I can fully endorse, in reference to the negro race, as forming the uneducated and laboring class of the Southern States. I cannot recall a single instance in which I have detected myopia in a full-blooded negro. With nearly the total absence of intellectual culture 10 years ago among the 3,000,000 of negro population of the Southern States of America, there was nearly a total absence of myopia. A similar statement has been made in reference to the absence of near-sightedness among the American Indians. They have, on the contrary, been always noted for their very sharp, distant vision. When the public-school system has been widely introduced among these primitive people, as is now being done among the colored population of the South, it will be found that with book knowledge will come eye defects as a regular sequence. American children of mixed, native and foreign parentage now start school life in the large cities with an aggregate of about 3 per cent. of near-sightedness, while the similar schools in Germany, made up of course exclusively of German children, exhibit 11 per cent. of near-sightedness among the primary classes. We have already stated that children of German parents in America give the largest percentage of myopic children to our public primary schools. Were it not for these we would start with a smaller percentage of near-sighted children than the 3 per cent. as already stated.

From these data, we prove not only that inherited eye troubles are greatest among the German population of any country, but

that among all cultured nations this inherited disease, which the children exhibit before their eyes are taxed with any hard work, was at one time acquired by their progenitors on account of eye abuse. In countries where the eyes are most taxed in early life by forced education, and where this has been going on for some generations, we find marked evidences of the gradual eye deterioration, not only in the number of spectacled parents, but also in their young offspring. This state of things augurs badly for the coming generations Luxurious living, and the desire to secure it for their family on the part of some, with the struggle for existence on the part of the masses, induces parents to accept the system of forced education for their very young children, and they prepare them for the great struggle by a very early beginning. In proportion to the study which these young people indulge in, their tendency to have yielding eye-balls is developed.

In analyzing with care the eye-sight of a large number of school children, and determining the cause of near-sightedness in connection with their daily mental work, it was discovered that the idle escaped this heavy tax, which bore most heavily upon the most industrious. Let us take the series of public schools in St. Petersburg, where, according to Dr. Erisman, the aggregate of the children start with 13 per cent. of inherited myopia. He selected out of several thousand children all those who studied two hours a day outside of the school-house, and found, by examination, that among these studious little ones near-sightedness had increased already to 17 per cent. Of those who studied four hours out of school, 29 per cent. of them had become near-sighted; and of the most industrious, who worked at their books six hours at home to ensure perfect marks from their teachers, in their competition for class prizes, over 40 per cent. had injured their eyes, and needed concave glasses for distant vision. All of this serious injury to the eye sight and its accompanying annoyances, which will continue during the long life time of the individual has been brought about by excessive, therefore, abusing use of the young growing eyes of childhood.

This is a very serious exhibit, especially when it is considered that an eye thus injured never recovers from this bulging of its

protective walls. It must remain ever afterwards, during the whole lifetime of the individual, a weak organ, exposed to many diseases which it would otherwise have escaped from, or not be liable to.

If these data be correct, and, unfortunately, we cannot make them otherwise, as they are capable of mathematical demonstration at any of our city public schools, are not the demands of a higher education for young children threatening the eye-sight of the race? When matured an eye can stand any amount of work, but during the age of growth, from 6 to 18, it must not be abused by over work. Myopia, which is a diseased condition of the eye, is immediately appended to the intellectual advancement of the growing population, and by them, when they in time become parents, it will be transmitted to their posterity. Each generation, in its turn, must increase the percentage of near-sighted children.

This proposition of transmitting acquired diseased conditions has been questioned on fallacious data. It has been said that a defect acquired through an accident is not transmissible, and that should the children, from the time of Moses, have had the left forefinger of the left hand cut off, the present generation would st ll be born with a finger ready for the amputating knife. Such, no doubt is the law of accidents, and fortunately the accidental mutilations of the body are not forecast in the successive embryos. But acquired diseases are not to be placed in this category of acquired accidents.

Our first parents were, no doubt, in every respect, types of health as well of physical development, with every organ properly formed and with perfect working power. Although people are still born with all the organs that Adam and Eve possessed, these respective organs have sadly changed from their first perfect standard. As generations have come and gone through their numerous multiplications we now find every species of inherited disease acquired by some of their offspring and then transmitted to after generations as the established condition of families. To a very appreciable extent, pathological changes do impress their kind or tendency on future generations, so that the facility to acquire seems to belong to certain families, classes, races or

nations, although not exhibited by all the members of the family. Hence, when some peculiar pathological change in cerebral matter has sent the head of the house to a lunatic asylum, although insanity has not been heretofore known in the family, we would not be surprised to find it hereafter developed in one or more of the children under special circumstances. A parent dies of acquired phthisis. The family tradition up to this time gives no record of such diseases; hereafter it establishes itself, and becomes the recognized hereditary family weakness. The same can be said of cancer, weak throats and other acquired diseases. So is it with near-sightedness, or long weak eye balls.

Human eyes were originally good, and among primitive races are still so. Under the pressure of early and close application, troubles first came, and they are being extended to posterity as hereditary transmissions. From a cancerous parent, all children are not necessarily cancerous; so from a myopic parent all the children are not necessarily near-sighted, but, at the same time, all do not invariably escape the parental infirmity. One or more will likely show the parental defect. Now bring in the forced education of the young children with its over study under defective hygiene, in a contaminated poisoned atmosphere with badly printed school-books, poor lights, etc., all of which have been clearly shown to create additional cases of myopia, and we see that there is good ground to fear that the coming race cannot have as good eyes as had their progenitors, and that eye disease must be on the increase.

A near-sighted eye is a weakened organ, and will ever remain so. An excessive degree of near-sightedness often induces diseases of so destructive a character as to cause the loss of all useful vision, and may lead to blindness. Should the acquired myopia of youth mark a great degree of yielding of the outer walls of the eye, the contents of this distorted eye-shell cannot avoid being seriously disturbed, to the great detriment of the visual organ. If up to the age of bodily maturity the eye has not yielded much, then the stiffening of the coats will protect against excessive changes, and the myopia may be arrested in its further progress. Should the eye-walls have bulged much before the scle-

rotic coat of the eye had attained its full resisting power, then the myopia continues to increase, which with advancing age and the constant use of the eye in the ordinary avocations of life, means a still further attenuation of the walls, and an increased structural weakening of the organ.

I have before said, that if near sightedness has not been acquired in the early years of school life, it is not likely to appear in the adult, however closely the fully matured eye is worked. Other eye annoyances may supervene in an over-worked adult organ, but myopia is not often found in this list. The needle woman, with matured eyes, can sew from early morning till midnight, and, because it is fully formed, the eye shell will perfectly resist this long kept up ocular congestion, although Sunday alone breaks the persistency of the ciliary muscular action, while weeks, months, years, and even a long lifetime, express the monotony of the every-day and all-day application.

In the young, growing, yielding eye-ball, we have seen that two, four, or six hours of steady application in acquiring book knowledge, not counting school hours, will have produced, respectively, 5, 15 and 30 per cent. of myopia, so that the tendency to near-sightedness in the young can be measured with some certainty by the number of hours of close application. These troubles which are always of a serious nature come from forcing the eyes of children; not those of adults.

All near sighted persons, regardless of the cause producing the defective focusing, see distant objects as if in a fog. This fog increases with the degree of elongation of the eye-ball, or with the convexity of the lens, until even comparatively near objects have very blurred outlines. Some moderately near-sighted persons are so little inconvenienced that they are not aware of their defect until contrasted with the sharper sight of others. On the other hand, many who exhibit a very myopic condition, when further questioned, cannot define the features of a person placed three feet from them.

The first intimation that a child's eyes are defective or are becoming so, comes in the form of complaints that the distant blackboard in the school room, which could be so distinctly seen

last year, is now very much blurred when viewed from their accustomed seat, and that the teacher has had to move their seat nearer to the board so that the pupil may see what is written upon it. When further questioned, these young people also complain that they cannot see faces across the street, and that they cannot recognize their own parents at a distance. Now that the child has called attention to some growing defect in the eyes, which had not previously existed, it is noticed that in studying at home the book is held much nearer to the face than formerly. If the parents are themselves near-sighted, they recognize the trouble in their child from their own familiar foggy outlines of distant objects. They may test them with the glasses which the parent wears, and if distant objects come out boldly under their use a similar pair of concave glasses are given to the child.

By this course the parent accidentally may be acting in a judicious manner towards his child. In by far the majority of instances, however, the supplying of concave glasses to the child without a careful and thorough examination of the eyes by some one skilled in this work, to see if the child is really near-sighted or not, would entail permanent injury. The myopia in this case need not be a congenital defect, and the over-work to which the young eyes have been subjected may not yet have caused organic changes distorting the walls of the eye. The child may be strictly one of that very large class of young persons who are only commencing to *acquire myopia through permanent spasm of the ciliary muscle*, and the case in this incipient form is not so far progressed but that it can be promptly and permanently cured.

Such a child may exhibit most of the signs of near-sightedness, but they may all be found fictitious, when carefully tested by one skilled in such examinations. She may have very defective distant vision, and yet not be a confirmed myope. The carefully prepared test types which should be readily made out by a perfect eye at twenty feet, may not be read by her at the distance of ten feet, or even of five feet. The optometer for measuring the range of accommodation, may show clear vision for only very near objects. Even the ophthalmoscopic examination may indicate myopic refraction. All of these evidences of myopia in

children are not conclusive, and may be fallacious, unless the atropia test be also applied. If, when the eyes have been saturated with a solution of the sulphate of atropia, grs. iv, to ℥j of rosewater, they yet show no change from the standard already elicited by the test types and the optometer, then the existence of myopia has been positively determined, and the correcting concave glasses for distances should be prescribed. The various mydriatics, of which atropia or duboisin are the best, are an essential element for determining the presence of permanent near-sightedness in children. No eye-glass should be given to a child without testing the eyes for focal range with a strong atropia solution. *Most near-sighted cases in children commence with ciliary muscular spasm, which, although fictitious, resembles myopia so closely as to be readily mistaken for that form of defect which is caused by an elongated eye-ball.* In all of these cases, and they are very numerous among young school children, the free local use of a strong solution of atropine can alone solve the problem. In no case can this eye-drop do harm. By expanding the pupil and paralyzing temporarily the ciliary muscle, it will put a stop to all reading, and will thereby compel the little patient to take the so much needed eye rest. In a few days, the effects of the atropine drop will altogether pass off, and with contracted pupil the eye will resume its former activity and acuteness of vision.

The following case will illustrate this defective condition of eyes among many school children, and is given as a typical instance of how fictitious near-sightedness is brought about by ciliary spasm. This muscular spasm is a *way station* in the development of permanent myopia, to which organic change it will surely lead if not recognized in time, and the proper remedy used for its arrest:

Sarah M., aged 13, a girl in good health, has complained for the last three months of pain in the eyes, and of not being able to see the blackboard from her seat in school. Last year she had no such difficulty; she could then detect any distant object that any other schoolmate could see. The eyes of the children in her class at the public school had been examined last season by a specialist in eye diseases, and she was put among those who had good eye-sight, both for distance and for near objects. Both of her parents have good eye-sight,

and the family are noted for far-seeing eyes. She was not aware of any eye defect until she was moved up to a higher class. From the beginning of the present session, she has been applying herself much more closely to her studies. Besides the school hours for recreations, she devotes to study all of the afternoon, and often evening hours until bedtime. The print in some of her books is very fine, and the paper of which the books are made is so thin that the type shows through the page, rendering the print in some places illegible. Her map questions annoy her much from the very small print used in the names of places. She had been at this hard work for six months when she noticed that her eye-sight was becoming defective, and that distant objects were as if in a fog. In blackboard recitations, she had been compelled to ask the teacher to allow her to sit nearer to the board. At first this change of place answered very well, but now, even at the nearer seat, the figures are as indistinct as they had been one month ago from the more distant bench. She thinks that resting her eyes makes her see a little clearer, and that on one occasion recently, when she had to be absent from school for one week, she could see much better the blackboard figures upon returning to school. A very few days' study brought back the cloud, and also the pain in her eyes, which she had not felt during her short holiday. It seems to her that the sight is getting worse every day. She is complained of at home for inattention, when she really cannot see the expression of one's features across the table. She has tried a pair of near-sighted spectacles belonging to one of the school girls, and sees beautifully with them. Her father, not wishing to purchase a pair of eye-glasses for her without knowing the exact number which her eyes require, preferred first to consult a specialist. I examined each eye for distant vision, and found that letters which a good eye should readily read at one hundred feet, could only be seen by her at eight feet—a reduction of her distant vision to $\frac{8}{100}$ of the normal, and what hers ought to be. She reads fine print readily at the usual distance of one foot. Looking through a ten inch lens at some fine print, she could only read it when it was approached to within six inches of the eye. From the six inch point to four inches she could read readily, but not beyond these limits. Two inches through a ten inch magnifying glass measured the extent of her accommodation.

The careless observer would say at once that here we had a case of progressive near-sightedness requiring a fifteen-inch concave glass for its correction, and would, therefore wrongly prescribe this number of spectacle, because by their use she can see letters marked for 20 feet at 20 feet, and, therefore, has distant vision perfectly restored. Before doing this, however, a careful physician would prefer making an ophthalmoscopic inspection to see whether the interior of the eye exhibits any evidences of a posterior yielding.

The lengthening of the antero-posterior diameter of an eye usually shows itself by an irregular, whitish mottling on the temporal side of the optic nerve entrance—a commencing atrophy of the choroidal boundary of the disc, called a crescent. In incipient myopia, there is no sharply-defined outline to this crescent, and the whitish mottling is restricted to a narrow half zone. In the course of time, the outline of this half moon sharpens, and by extending in area, indicates that the near-sightedness is decided and permanent.

In the case of Miss M., the optic nerve entrance was sharply defined and uniformly round, showing that the ophthalmoscope revealed no cause for her short sight. The rapidly-increasing near-sightedness, and the usual additional application since the new school term, based upon a good eye of six months back, leads me to suspect that the apparent myopia is of that fictitious kind induced through spasm of the ciliary muscle. If not recognized and judiciously treated, this leads surely to organic changes in the eye-ball, and becomes a case of confirmed myopia. To determine this most important point, I instilled into each eye a four grain solution of the sulphate of atropia —the patient lying upon a lounge, so as to allow the drops to remain for a few minutes in contact with the cornea for absorption, and to produce their full action. At the end of an hour, the pupils were found much enlarged, and distant test types could then be more readily seen. She read No. 30 at 20 feet, and by the aid of the optometer, with a ten-inch lens, the near point had receded to 8 inches, she reading from 8 to 9 inches. This limited degree of visual range, which could still, however, be exercised, showed that the ciliary muscle had not yet altogether relaxed, and that by its action too great convexity of the crystalline lens was still kept up The patient was given a small quantity of the four-grain atropia solution, with instruction to have it dropped into the eyes three times a day, and to return on the morrow for inspection. At the next examination, after four instillations of atropia, she complained that her vision had again become misty, and that nothing was clearly seen. She could not make out any kind of ordinary book print, and standing at 20 feet from the test types, she could only see letters which should be read at 70 feet She was now tested with the ten-inch optometer, and her nearest and only point for reading was at 15 inches from the lens. *The atropia action in her case had solved the problem, and had dissipated all the symptoms of the fictitious myopia.*

By this valuable test the patient was proved to be not near-sighted at all. She was, on the contrary, over-sighted—a condition known as hyperopia—just the antipode of myopia. Instead of having her eyes elongated by the over-work, nature had made her with an eye too short in its diameter behind the pupil, necessitating some effort to

focus even distant light, and of course with increased effort for near work. This is just the opposite of the long eye of myopia. As long as the eyes were not called upon for excessive application, this defect in the construction of the eye was not felt. When greater demands were made by more studious habits, and the ciliary muscles were inordinately taxed to make the lens very convex so as to cover the defect of shape in the eye-ball, then muscular irritability ensued, and finally the muscles became spasmodically contracted, as a permanent state. They would not relax during the comparatively short interval of rest from study, and hence the lens kept in a too convex state—lost all of its ability to condense distant light. In its fixed, abnormal condition of excessive convexity, it could only focus light from near objects, and became, on this account, practically a near-sighted eye. When the ciliary muscle had been temporarily paralyzed by the atropia, we could examine the eye in its normal state, and find that, instead of requiring a concave lens, as heretofore believed, the very pair of friend's spectacles, which yesterday helped her so much in seeing distant objects, now blurs them the more. A thirty-inch convex glass was the one which, in the dilated condition of the pupil, cleared up distant objects, and restored her to $\frac{20}{20}$ vision.

The course to pursue with this young girl, to prevent her from becoming near-sighted, was very simple. Remove some of the strain from the eye muscles by aiding them in the condensation of light. The magnifying glass, with which she can see most distinctly distant objects when the eye is fully under the effects of atropia, is the glass which she should wear at all times, both for walking and reading, and they should be put on at once. Gradually the effect of the atropia will pass off, and in ten days she will be able to read again and resume her school work with her spectacles. The ten days' rest has done her eyes immense good. It has enabled the long-continued congestion to pass off, and has put the eyes in a much more healthy condition for work. After wearing the magnifying spectacles for some weeks, she can discard them for walking, provided she never studies without them. At the end of school life, she will be able to discard glasses altogether, and will find her eyes strong for all ordinary uses, without the use of spectacles.

Suppose, under bad advice, or by her own selection, the myopic glasses, which seemed to her so useful, had been adopted. The true condition of over-strain would never have been discovered. The momentary clear vision, produced by concave spectacles, would have become so dim in a few days or weeks as to necessitate the use of stronger lenses. The eyes, constantly under congestion, and with increased straining on the part of the ciliary muscles, would have become painful, and would finally have given way by the yielding of the protective coats. The result

would have been a progressive myopia, organic and not functional in character, and therefore a permanent eye defect.

The case of Miss M. is the history of thousands of industrious school-children, anxious to excel in their recitations, and daily stimulated by ambitious teachers, thoughtless of what physical injury they inflict upon their scholars, provided long lessons can be accurately committed to memory.

Should Miss M. be allowed to follow the course which her teacher had mapped out for her, and had neglected professional treatment for her eyes, it would have been a very easy matter to foreshadow her future, for we are frequently called upon to examine just such neglected cases. She perhaps would have had the one great and very transient satisfaction of receiving on graduation day the highest award of the school. She would have entered the world possibly very wise as to school-book learning, but with poor health, a pale face, and with the knowledge that she has a pair of eyes which resent, with pain, any long-continued use. Without concave glasses, the outside world is to her a blank. Without them, her friends are not recognized as they pass her on the sidewalk. A few years may have elapsed since school days closed, and much of the book-learning has been forgotten, because not wanted in the practical affairs of every-day life. But the eye discomfort, acquired in the ardent desire to have perfect even if useless lessons, is ever present, and pregnant with anxieties for the future. Whenever impaired digestion, the sequel of sedentary habits, makes her nervous, spectra of losing vision haunt her. The inducements held out to her of being the prize scholar has turned out an empty honor, and promise to embitter her life.

When the attention of the medical friend of the family is called to the growing near-sightedness of children, instead of suggesting near-sighted glasses, it would be well for them, in every instance, to see the effect of a strong atropia solution on the eyes. This atropia drop will never do injury in such cases. The rest from study, which the belladonna alkaloid will ensure, will be in itself a great comfort to the over-taxed organ. If distant vision improves when the pupil becomes thoroughly expanded, showing

conclusively that the near-sightedness was of that delusive, fictitious kind induced by the over-straining and long-continued spasm of the ciliary muscle, then a weak magnifying glass, to be used for all near work, will prevent a return of the annoyance, especially if there be some relaxation from and diminution of too much study.

This simple treatment of belladonna application, with the rest it gives to the fatigued organ, and with the valuable information which it elicits, can never do harm. *It alone will be the means of preventing in thousands of children cases of apparent myopia from becoming permanent, life-long defects.*

Among patients which a specialist is daily examining, he very often finds cases which the following will fully cover:

James H., aged 16, recently promoted to a collegiate institution, has been a special favorite with his teachers on account of very studious habits. For some time he has been aware that his eyes were weak, as he often has headache and pain in the eyes from study; also that his distant horizon had become much befogged. This was not the case three years since, when he often tested his eyes in detecting small, distant objects during his many steamboat excursions. For the past two years he has been much of a book worm, and has been encouraged to use all his time not absorbed by his lessons in desultory reading. His greatest annoyance at present is during blackboard recitations, especially in algebra. Unless standing near the blackboard, he cannot detect a single character, and is often placed at disadvantage before his class-mates on account of his defective vision. In reading, he has no trouble, and does not hold the book nearer than the usual distance of twelve inches. Near-sightedness is not a family defect. He is one, the eldest, of four children; all the others with good eye-sight. His parents have no eye defects. Examined by the test types, he has only one-sixth of the normal distant vision. Figures seen at 100 feet by good eyes, he approached within 15 feet before detecting them. In drawing his eye-lids closely together, so as to convert the palpebral fissure into a linear splint, he sees distant objects much better. Under the local use of atropia, no material improvement is made in his distant vision; and although the newspaper print is somewhat blurred, he can still make it out. Concave glasses clear up his distant horizon. The ophthalmoscopic examination indicates a myopic reflex of the retinal vessels, and shows that an irregular, whitish, mottled area of choroidal absorption extends for some distance on the temporal side of the optic nerve entrance. This choroidal atrophy has already been referred to as a crescent, and denotes the fact of an established myopia by the posterior bulging of the eye-shell. It also indicates that the near-sightedness has been acquired by

the over-use of the young, soft, yielding, growing organ. As the mottling is not sharply limited by healthy red choroidal tissue, but is irregularly scattered for some distance around the optic disc, it is also an indication that the case is one of progressive myopia, and that close application will increase the troubles. The concave eye-glass becomes an essential to Master H., and has already established itself as a life-long appendage, never to be discarded if clear distant vision is to be desired. The eyes of Master H. have been already seriously and permanently damaged by too close application to books, and if, under bad advice, his ambition to continued over-study is stimulated, it can only be at the expense of this most valuable organ, which must hereafter be called a diseased eye. He is now laying the foundation for future trouble, and possibly, in the end, loss of useful vision His best course, for the safety of his eye-sight, would be to give up study for the present, and take up some out-door occupation until such a time as the choroidal atrophy should become sharply defined, and the sclerotic coat relieved of constant congestion. When the coats of the eye, become firm, he may resume study with much better prospect of keeping good eyes in his advanced age.

These two reported cases, that of Miss M and Master H., from the bulk of the material for acquired myopia among young scholars, the first preparing to become near-sighted and the second progressing rapidly in it. It is between the ages of 8 and 18 that most cases of myopia acquire the near-sightedness.

We have so far thrown out that small list of hereditary myopia, cases where children are born with eyes already too long in their antero-posterior diameter. Such eyes, although weak in configuration, are not necessarily diseased; but, if pressed with hard work while still young, they are predisposed to give way with what would be called progressive myopia. These need concave glasses to see clearly distant objects at even an early age.

We find a fourth form of acquired myopia. This time it is with old persons, in good health. They cannot accuse their eyes of over-work. On the contrary, they have never over-taxed the eyes at any time from childhood up. The following case will represent this very interesting form of eye defect:

Mr. S., aged 75, has gone through life with no eye discomfort. He found, at the age of 45, that he could not read fine print with his former facility. Marginal notes he had to abandon, even when he could enjoy the strong light of an open window. For evening reading the selection of a good, bold print was a matter of some impor-

tance, and newspaper reading at night had been discarded. He was advised at that time to get the magnifying glasses which the beginning of old age requires. With the use of these he found much solace. By their instrumentality, he had been able to resume night-reading, which he has steadily kept up. From time to time, he has changed the spectacles for stronger ones. Commencing with No. 48 magnifying, he changed them every two or three years, using, respectively, those which focus at 36, 24, 18, 14, 12, 10, and finally at 8 inches. The last strong spectacles he has used since he was 70 years of age. Two years since he discovered that in reading with his glasses he had to hold the book very near to his face, and one day, taking up the newspaper, he found, to his surprise, that by holding the print at a distance he could discipher it without his glasses. For the past two years he has discarded spectacles for reading altogether, and has rejoiced in the restoration of a second sight. For the past twelve months he has become aware that the faces of friends across the street are not so easily detected as formerly, and he often passes persons unintentionally without recognition. It is this closing in of his area for distant vision that has induced him to seek advice.

I find that Mr. S. has suffered no eye pain at any time, and that this recently acquired short sight is his chief discomfort. He reads book print at the usual distance of 12 inches without much difficulty, and does much of it during the day. When tested by the larger type from the distance at which he is sitting, 18 feet, he could only read off specimens of type which can be readily seen by a good eye at 100 feet. His near, clear sight and distant, foggy vision establishes in his case myopia and that evidently acquired within the last twelve months. I used atropia with him, and his distant vision did not clear up in the least, whilst his near vision became disturbed. The ophtalmoscopic examination explained to us the cause of the error of refraction. In the retina, choroid and sclerotic coats, or at the optic nerve entrance, we found no changes whatever from the normal condition. It was in the lens substance that the alterations were found. Upon the very edges of the crystalline lens, in that portion of the periphery usually covered by the iris in the ordinary contracted state of the pupil, I saw one or more delicate black lines, resembling cracks in a pane of glass. They extended from the margin towards the centre of the lens, and in the direction of the pupil, and indicate that the near-sightedness resides in progressive changes in the lens substance.

These clouded lines may streak but one side of the lens border or they may be more or less disseminated around the entire outer margin of the lens. Sometimes there is but one single dark stripe, not more than one or two lines in extent, which alone mars the complete transparency of this brilliant body. That single flaw is, however, enough to explain the near-sightedness, and will, with certainty, foretell that in time a cataract will develop in that eye, of which this line of fatty degeneration or organic change is the sure forerunner.

The privilege of second sight, unless it appears at a very old age, is seldom an enjoyment of long continuance. Should this privilege be secured before 70, it foreshadows cataract blindness not very many months or years ahead. When second sight appears in persons of 80 and upwards, although it is usually of the same pathological significance, the lens changes are so very slow that general senility may carry off the person before the opacity in the lens has made sufficient advances to be annoying, in the daily uses to which the eye is put.

In these cases of acquired myopia in old age, an explanation is found in the fact that the lens of a person growing old is condensing, dessicating, and therefore shrinking. It is this perfectly natural flattening of the lens, a process which goes on perceptibly in every person from 40 to 70 years of age, and which necessitates with us the supplementing of the lens by spectacles. These magnifying glasses must increase in strength *pari passu* with the steadily progressive lens shrinkage. Preparatory to the formation of cataract in some of these old persons, the lens commences to imbibe fluid, and becomes more juicy. The fibrous tubes, of which millions are found in the many laminæ of the lens, suck up fluid from the aqueous liquid from which it draws its normal supply of nourishment. This imbibition of fluid swells the lens within its elastic capsule so as to make it very convex, a strongly magnifying body, only capable of focusing at short distance For many months, the lens, altered in shape and made very convex, may still retain its perfect transparency. After a while, opaque streaks and spots make their appearance in it, and in time the whole lens loses its clearness and becomes a cataract.

Concave glasses for a short time will correct the excessive refraction for this acquired myopia of old age, when the crystalline lens, by recent swelling, is preparing to become opaque with cataract. In the progress of degeneration of the lens substance, when light becomes impeded in its passage to the retina, foggy sight comes on for all objects, both near and far.

Of the five kinds of myopia which I have tried to describe, the last—viz; that coming on in old age—is the most rapidly progressive, and is that form of myopia the most speedily converted

into very defective vision for both distant and near objects, by clouding of the lens substance. The near-sightedness which follows upon the acquisition of the second sight, is as a rule only temporarily relieved by the use of concave glasses, but it can finally be removed altogether by a successful operation for cataract extraction. In all such cases skillful surgery offers nearly a certain promise for the perfect restoration of vision.

The second form of acquired fictitious myopia in young persons, viz; that brought on by exciting the accommodating muscles within the eye into a more or less permanent spasmodic contraction, is to be detected through the relaxing influence of a strong solution of atropia. The constant wearing of a suitable convex eye-glass for all near work will prevent a recurrence of the muscular spasm and cure the apparent myopia.

The congenital myopia, which is a mis-shaped eye, inherited from near-sighted parents, also that more common form of eye bulging, the result of long-continued congestion kept up by too long neglected over-work of the eye muscles, can only be corrected by the judicious selection of concave spectacles. These near-sighted glasses are to be worn, in most cases, only for distant vision. If the case be one of excessive elongation of the eye diameter, requiring the book to be held within six inches of the face when reading, a weaker concave glass than the one used for distance will be necessary to enable the book to be held at from 12 to 14 inches. This weak lens may be constantly worn with comfort and advantage.

There is no sanitary question at present exciting the attention of the medical world of greater interest than the hygiene of the eyes. How shall we take care of the eyes of the growing race so as to keep them in the good condition with which they start life? is the most absorbing subject. With very few exceptions, nature makes the eyes right. Injury usually comes to them from abuse, especially during school life, in acquiring book lore, much of which is discarded as soon as the scholars control their own actions.

Near-sightedness is the diseased condition which over-work at school engenders. By this judicious selection of school-rooms,

with good light and good ventilation, with plainly printed books, and a moderate amount of studies, much can be done to prevent this disastrous consequence to the young growing race, and consequently to the next generation.

That acquired myopia when well established, is an organic disease of the eye which can be afterwards transmitted to offspring is too often seen to be doubted. A case in support of this statement has just consulted me, and her family history is in common with that of a great many others :

Mrs. B., of Ohio, aged 57, has been near-sighted from childhood. Both of her parents had excellent sight. She was a precocious child, and when still very young became engrossed in books. At a comparatively early age she put on near-sighted glasses, and has worn them as her constant companion throughout her adult life. She has on at present excessively strong concave spectacles of two inches focus, and even these give her very little distant vision. Her eyes are now so much affected that she can no longer read ordinary print; and they have given her much pain of late. The right eye, which, for many years, has been her chief dependence, has recently given out entirely. The left eye, for a long time known to be very weak, is now her only useful visual organ. An ophthalmoscopic examination which I made of her eyes explained her defective vision. Around each optic disc there was a large area of choroidal atrophy, which always means retinal destruction over such atrophic spaces. This condition of great stretching in the right eye had led to a detachment of the retina at the yellow spot, that important centre for sharp sight, and has made the eye permanently and incurably useless. In the left eye the choroidal atrophy was encroaching also upon this important retinal centre, so that this eye also is threatened with destruction at no distant period. All of this serious injury can be traced unfailingly to the yielding of the eye-walls from over-work in childhood. She is the wife of a gentleman who has perfect eye-sight. By him she has three children, only one of whom has good eyes; the other two have been near-sighted from early life. In this instance, as in innumerable cases, the mother's acquired eye defect has been directly transmitted to two out of three children.

The hygiene of the eyes should be carefully studied by parents and by teachers. Children in early years should not have their eyes taxed to their life-long injury. If in many of our schools for the young, more time were given to physical culture and less attempts made to force intellectual development, there would be less eye tax, and consequently fewer eyes defect. In

most cases with children under 13 years of age it would be far better to restrict study hours rigidly to school hours, and leave the books in school, to be resumed on the following morning. The amount of indifferent and often useless knowledge, acquired by the over-work of the eyes of school children, is a very miserable compensation for the life-long annoyance of weak eyes and acquired near-sightedness, with the long train of annoyances more or less serious which led to a diseased condition of the eye sight. These remarks are especially applicable to the education of girls. Very few young ladies who receive the so-called higher education ever make it available for teaching. To the great majority of the pupils many of the studies in the female high schools are of a thoroughly useless, as well as often of an annoying description. Algebra, geometry, the higher mathematics, and other studies equally valueless to the majority of ladies, as their every-day life exhibits, absorb many months of close and injurious application. After the final examination, these studies are most gladly dismissed, never to be resumed, and are very soon forgotten. Would that the effects upon the eyes, induced by their study, with the diseased condition of acquired myopia, and the bodily infirmities which come from the close confinement, could be as readily thrown aside.

The uselessness of many of these studies was forcibly brought to my notice a few months since:

Mrs. W., a former patient, brought her daughter, 13 years of age, to me for treatment. The child had been advanced to classes beyond her age, and could be, with difficulty, restrained from reading, to the exclusion of all other domestic duties. Myopia had already become positive, and a concave glass was necessary for seeing at even short distances. While referring to the over-taxing at school, compelling night as well as day study, the mother had taken no steps to restrain this young child from so much eye work. She happened to remark that her eldest daughter, aged 17, had just graduated at the Female College, and that she had come out among the first in her class of over 200 girls. She was glad that her daughter had finished her school education, as she had become very near-sighted, and often complained of pain in her eyes with headache. The lady referred with pride to the high grade which her daughter had taken in geometry and algebra. I suggested the remark that these higher mathe-

matical studies were utterly valueless to young ladies, as they were to most collegiate graduates, and that they could not take the place of the simple mental arithmetic so valuable for every day use. I asked the simple question, Whether this educated mathematician could tell by mental process without the use of pencil and paper if her change is correct in shopping? The mother had to confess that this part of her mathematical studies had been woefully neglected. It was expected that this young lady would in time have a house of her own to manage, and not a class of pupils to instruct in the higher mathematics. Most of these two hundred young ladies who had gone through the same course of theoretical study for graduation expected to be similarly engaged for the balance of their lives in the practical affairs of domestic work.

If a pupil, restrained when young, shows in maturing years any desire to study, one year's close application after the age of 17, will advance an education more than several years of work in early life. At the age of 20, the eye-walls have hardened so that no amount of eye work is likely to make them yield, or disturb the nice adjustment which nature desires to provide.

Our present system of forced early education for both sexes offers some points for thoughtful consideration. Girls up to 15 years of age are, as a rule, brighter than boys, and can under similar circumstances, be further advanced in education. Of a more domestic turn, they take readily to books, and can be the more easily induced to study. At the age of 16 or 17 most of the female world is supposed to be sufficiently educated to fit them for society; hence, the last two or three years has been a cramming one at the schools, necessitating the use of all day light and many gas light hours to secure good recitation marks. While the girls are at their studies desperately driving their weak eyes to their serious and permanent detriment, boys are on the play-ground developing their physical frames and laying up a store of vital force which will enable them to work harder during college life. Close mental and eye work with the youth usually commences at a period of life when the young lady leaves school. Nature, however, has not foreseen the necessity for this earlier education of the female and will make no provision for an earlier perfect development in the growing eye of the girl over that of the boy. The maturing condition of the eye will explain why the education task of the girl from 13 to 17 is so much a greater strain on

the eyes than that of the youth between 16 and 20, which are the years of his college life. With the older persons, the eyes are becoming daily more firm and strong to stand work without detriment. The younger the eye is forced, the more readily it gives way. In Germany, where the forced education in very early years is the law of the land, myopia, or near-sight weak eyes, abound. In England, where the school life is at a more advanced age, near-sightedness is the exception. It is easy to draw a valuable moral from these data.

Fortunately, all children who study hard do not become victims to myopia, otherwise the race would soon be in a very bad way indeed. Would that no child became myopic, and that near-sightedness could be neither acquired nor hereditarily transmitted. Family medical advisers would act most wisely if they recommend that all annoying and useless lessons be stopped as soon as they find the eyes of children taxed to injury by their acquisition. When a young girl who does not expect to be a school teacher, finds her eyes painful and misty after some hours' application upon the closely and badly-printed school-book, better advise her to cast such a book aside, and devote that time to recreation in taking out-door exercise. A stock of general health is worth much more in the family circle than the acquisition of a gold medal or than a knowledge of many useless books. It is far better that young growing pupils who are not strong physically, should take school book knowledge,—which is not always the most useful knowledge,—in moderation, rather than obtain a large degree of early brain development without a healthy body to sustain it.